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1416731

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(19)

(54) APPARATUS FOR CONTACTING LIQUID AND VAPOUR

(71) We, SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ N.V., a company organised under the laws of The Netherlands, of 30 Carel van Bylandtlaan, The Hague, The Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to apparatus for contacting liquid and vapour, which comprises a column or a column section with trays provided with vapour passages and with liquid discharge means each consisting of oblong basins arranged in parallel and being open at the top, which basins extend partly above and partly below the tray, with the open top above the tray, whilst the bottom part is provided with discharge openings.

The term "vapour" is used herein to include gas. Such columns are suitable for processes like distillation, absorption and stripping. Sieve trays, grid trays and valve trays can conveniently be employed.

The use of a plurality of oblong basins as downcomers on a tray renders it possible to discharge the liquid more uniformly from a tray and supply it to the next lower tray than can be done with downcomers disposed adjacent the column wall. Also, a greater weir length can then be obtained, so that operation at a higher liquid load becomes possible. Moreover, the basins serve a liquid/vapour separator, to the extent of separating from the down-flowing liquid any vapour that flows over the top edges of the basins along with the liquid. The basins may be provided with baffles in and/or above the open top as catching means for liquid. Specification 1,117,338 discloses a vapour-liquid contact system in which oblong basins are employed. The present Applicants have found that the positioning of a plurality of oblong basins on a tray requires great care, because liquid flow patterns are greatly influenced thereby. It should also be ensured that the active surface area of the tray remains a maximum. The provision of oblong basins alone results in a favourable ratio of weir length to surface area occupied. This is of importance for processes under elevated pressure, where the liquid load is high. The present Applicants have also found that particular attention must be given to the nature of the discharge of liquid from one tray to the next, and the present invention provides an improved system in this respect.

According to the present invention there is provided apparatus for contacting liquid and vapour, which comprises a column or a column section provided with trays each of which trays has vapour passages and a plurality of liquid discharge means associated therewith, each of said liquid discharge means comprising an open-top, basin of oblong horizontal cross-section extending partly above and partly below the tray with which it is associated, and the liquid discharge means of each tray being arranged in parallel, wherein the lower part of each basin is provided with discharge openings in at least the side walls thereof, the discharge openings in said side walls being adapted to discharge liquid in outwardly directed streams each having a direction of motion normal to said side walls, and wherein the trays are disposed in the column or column section in such a manner that the basins of any one tray are disposed crosswise with respect to the basins of the next adjacent trays, the arrangement being such that all the discharge openings in the lower part of each basin are located above active surface areas of the next lower tray.

At least part of the liquid discharged from a basin of a tray flows on to the tray below in outwardly directed streams, with the result that this liquid is distributed more evenly over the active surface areas between two basins of the suceeding tray than is possible when the liquid is discharged vertically downwards with little or no direction of motion normal to the sides of a basin. This is of importance, since the liquid-vapour contacting processes equal residence times for each and every liquid particle on

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a tray must be aimed at. The discharge openings in the side-walls of the basins of apparatus in accordance with the invention may be combined with downwardly directing outlets in the bottom of the basins. The basins of any one tray may be provided with discharge openings over such a length that substantially the whole of the active surface area between two basins of the next lower tray is covered. The discharge openings may consist of slits or round holes, and the design may or may not embody profiled walls and/or liquid seals.

The invention will be illustrated with reference to the drawings accompanying the provisional specification (Figures 1 to 3) and the accompanying drawing (Figure 4), in which:—

Figures 1 and 2 show a cross-section and a longitudinal section of a column with two trays according to the invention, figure 3 shows a perspective view of a part of a column with three trays, and figure 4 shows a construction of a tray.

In the figures 1 and 2 the column wall is indicated by 1 and 2 and 3 are trays with peripheral beams 4. Tray 2 is provided with liquid discharge means 5, and tray 3 is provided with liquid discharge means 6. The liquid discharge means are provided with discharge openings 7 in the side-walls. The crosses in figure 1 and the arrows in figure 2 indicate the locations on tray 3 where liquid from tray 2 is supplied.

In figure 3 the trays 8, 9 and 10 are provided with liquid discharge means 11, 12 and 13, respectively. The liquid discharge means have discharge openings 14 in the side-walls and vertically downwards directed discharge openings 15 in the bottom thereof. Arrows 16 indicate the locations where liquid from the liquid discharge means is supplied to the receiving tray.

A tray with oblong basins may be constructed as shown in figure 4. The tray is built up with reversed U-shaped beams of which the downwards bent parts 17 form the greater parts of the side walls of the basins. The horizontal parts 18 of the reversed U-shaped beams are perforated and form the tray with the gas passages. The basin parts above the tray are formed by strips 19. In this case liquid-catching baffles 20 are shown. A stiff tray is obtained in which the U-shaped beams are the load-bearing parts.

WHAT WE CLAIM IS:—

1. Apparatus for contacting liquid and vapour, which comprises a column or a column section provided with trays each of which trays has vapour passages and a plurality of liquid discharge means associated therewith, each of said liquid discharge means comprising an open-top, basin of oblong horizontal cross section extending partly above and partly below the tray with which it is associated, and the liquid discharge means of each tray being arranged in parallel, wherein the lower part of each basin is provided with discharge openings in at least the side walls thereof, the discharge openings in said side walls being adapted to discharge liquid in outwardly directed streams each having a direction of motion normal to said side walls, and wherein the trays are disposed in the column or column section in such a manner that the basins of any one tray are disposed crosswise with respect to the basins of the next adjacent trays, the arrangement being such that all the discharge openings in the lower part of each basin are located above active surface areas of the next lower tray.

2. Apparatus according to claim 1 and substantially as described hereinbefore, with reference to Figures 1 and 2 or Figure 3 of the drawings accompanying the provisional specification or Figure 4 of the accompanying drawings.

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1416731
2 SHEETS

PROVISIONAL SPECIFICATION

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Sheet 1

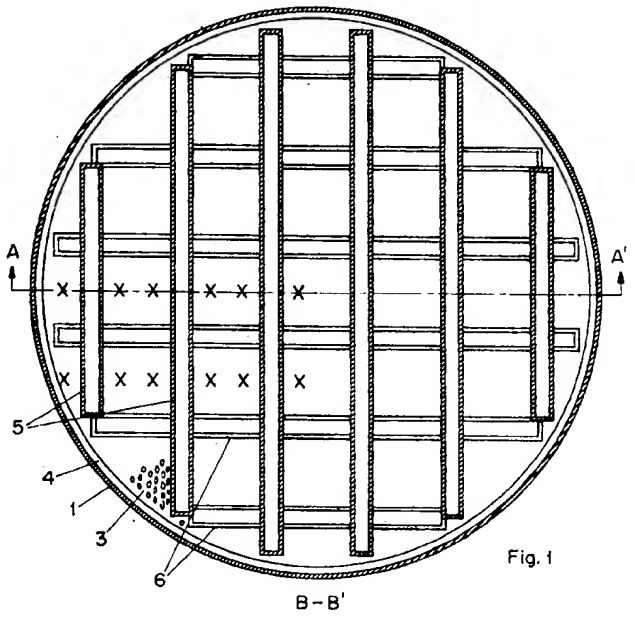

Fig. 1

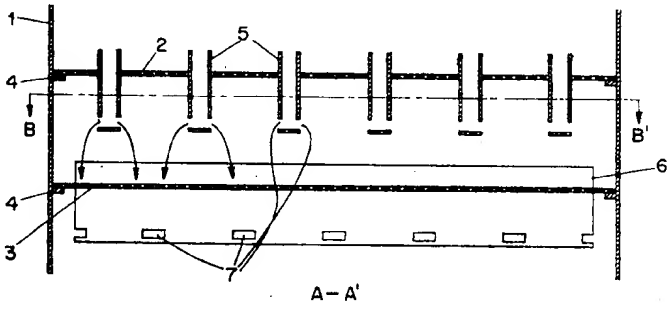

Fig. 2

1416731 PROVISIONAL SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

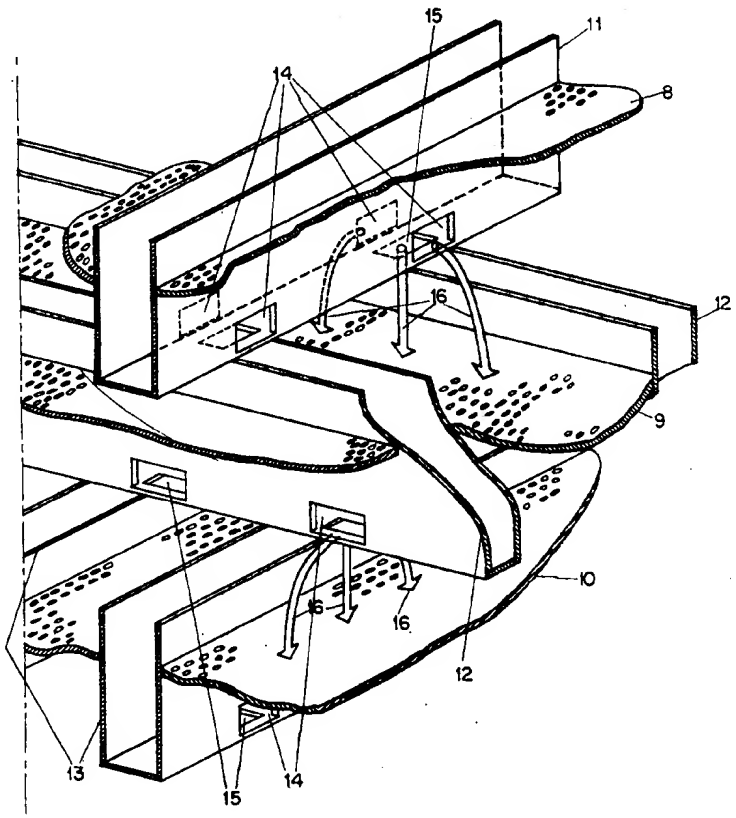

Fig 3

1416731 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

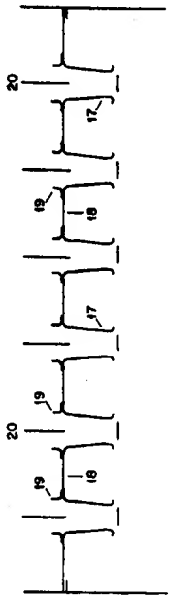

FIG. 4